









First record of *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 (Diptera, Psychodidae, Phlebotominae) in the state of Rio de Janeiro, Brazil

Thamiris D’Almeida Balthazar^{1,2*}, Antônio Luís Ferreira de Santana¹, Luiz Henrique Costa¹, Jacenir R. Santos Mallet^{1,2,3}, Maurício Luiz Vilela^{1,2}

1 Laboratório Interdisciplinar de Vigilância Entomológica em Diptera e Hemiptera, Instituto Oswaldo Cruz, Fiocruz, Rio de Janeiro, RJ, Brazil • TAB: thamirisbalthazar@gmail.com  <https://orcid.org/0000-0003-4357-0399> • AFS: anthonio@ioc.fiocruz.br  <https://orcid.org/0000-0001-5981-8673> • LHC: lhcosta@ioc.fiocruz.br  <https://orcid.org/0000-0001-6645-7028> • JSM: jacemallet@gmail.com  <https://orcid.org/0000-0003-4728-7638> • MLV: mvilela.fiocruz@gmail.com   <https://orcid.org/0000-0001-7610-0719>

2 Programa de Pós-graduação em Medicina Tropical, Instituto Oswaldo Cruz, Fiocruz, Rio de Janeiro, RJ, Brazil

3 Universidade Iguazu, Nova Iguaçu, RJ, Brazil

* Corresponding author

Abstract

In an investigation carried out at the headquarters of Jequitibá in Três Picos State Park, the presence of the sandfly *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 was observed. Morphometric analyzes of the sperm pump and aedeagal ducts and photographs of the structures were performed to compare the differences between *Migonemyia vaniae* and *Migonemyia migonei* (França, 1920). Since its description, *Mg. vaniae* has been recorded only in the state of São Paulo. Therefore, we report the first encounter of this species in the state of Rio de Janeiro.

Keywords

Atlantic Forest, distribution records, sandfly

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Introduction

Sandflies are blood-feeding dipterous insects of the subfamily Phlebotominae in the family Psychodidae and present preferentially nocturnal twilight habits. These mosquitoes are the vectors of the leishmaniasis disease, which is caused by many trypanosomatid species of the genus *Leishmania* (Ross, 1903) (Rangel and Lainson 2003).

Currently, 1047 taxa of subfamily are described worldwide, including 1016 extant and 31 fossil species. In

the American continent, there are 546 species known—529 extant species and 17 fossil species (Galati 2019)—and about 10% of the extant species may be involved in the transmission of human pathogens (Seccombe et al. 1993; Young and Duncan 1994; Maroli et al. 2013). The lack of ecoepidemiological studies in uninvestigated regions suggest that only a small portion of the estimated total arthropods in the world are described (Hamilton et

al. 2011; Basset et al. 2012; Lamarre et al. 2016).

The Três Picos State Park (Três Picos State Park) is located in serra do Mar, in the mountainous region of the state of Rio de Janeiro, covering an area of 65,113 ha of the state, where the highest biodiversity index in the state is located. It is the largest nature conservation unit in the state and is within the limits of five municipalities: Cachoeiras de Macacu (about two-thirds of the park's area are in this municipality), Nova Friburgo, Teresópolis, Guapimirim, and Silva Jardim. The park protects a fragment of Atlantic Forest composed of dense ombrophylous forest and tropical climate (INEA 2009). The headquarters of Jequitibá is in the municipality of Cachoeiras de Macacu, about 400–500 m above sea level. Surveys of the sandfly fauna have previously been carried out in PETP.

Here, we report the first record of *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 in the state of Rio de Janeiro. This species was described from material collected in the Ribeira Valley, near the Alto da Serra de Paranapiacaba biological reserve in the state of São Paulo (Galati et al. 2007). Our new record expands the known geographic distribution of this species, which until now was thought to be restricted to the state of São Paulo.

Methods

Field campaigns were carried out under collection authorization (no. 058/2015) of the Instituto Estadual do Ambiente (INEA). Monthly captures were made in PETP, at the Jequitibá headquarters located in Cachoeiras de Macacu (22°24'57"S, 042°36'30"W), with the use of CDC light traps model HP (Pugedo et al. 2005) for approximately 24 h from November 2016 to October 2017.

The traps were arranged in five monitoring stations (MS) established according to the tracks present inside the headquarters, these being: MS1: entrance of headquarters, near bamboo plantation (22°24'50"S, 042°36'49"W); MS2: Crystal Trail, near the waterfall (22°24'58"S, 042°36'33"W); MS3: Giant Jequitibá Trail, near Jequitibá (22°25'04"S, 042°36'37"W); MS4: Observatory Trail, climbing near the lake located at the park's head (22°24'53"S, 042°36'32"W); MS5: trail behind the visitation room near the waterfall (22°25'01"S, 042°36'23"W).

The collected material was euthanized by freezing and then preserved in alcohol 70%. In the laboratory, the sandflies were submitted to a process of clarification and diaphanization in Elisa plates. The process was initiated with the immersion of the sandflies in 10% potassium (KOH) for 2–3 hours; they then were immersed in acetic acid for 20 min to remove excess fat and washed in type II water for the amount of time, and finally put in lactophenol for 24 h to clarify the structures used in the diagnosis of the species (Vilela et al. 2018).

Male and female sandflies were mounted on a slide in Berlese liquid with a coverslip using a stereoscopic microscope. Specimens were identified under an optical

microscope with the aid of the dichotomous key proposed by Galati (2003, 2019). Abbreviations of species names are as suggested by Marcondes (2007).

Our slide preparations of *Mg. vaniae* and *Migonemyia migonei* (França, 1920) were photographed under an optical microscope (PrimoStar, Carl Zeiss) with an AxioCam camera (Carl Zeiss). The Carl Zeiss Imaging Systems v. 4.7.2 was used to perform measurements of the ejaculatory sperm pump and aedeagal.

Results

After 12 months of capturing sandflies, two male specimens identified as *Migonemyia vaniae* were collected. One specimen was collected in March 2017 and another in October 2017, both at MS4: Observatory Trail, climbing near the lake located at the park's head.

New records. BRAZIL – Rio de Janeiro • Cachoeiras de Macacu, Três Picos State Park, headquarters at Jequitibá; 22°24'53"S, 042°36'32"W; 464 m alt.; 15.III.2017; T.D. Balthazar leg.; light trap CDC; 1 ♂, Colfleb NE 3289/21 slide no. 91897 • same locality; 19.X.2017; T.D. Balthazar leg.; light trap CDC; 1 ♂, Colfleb NE 3990/21 slide no. 91897.

Identification. We identified specimens of *Migonemyia migonei* and *Migonemyia vaniae*. These two species present a short first flagelomer (F1), smaller than ½ of the head length (Fig. 1A, B), and genitalia with the internal spine implanted very close to the apex (Fig. 1C, D), as described by Galati (2003, 2019) and characteristic of species belonging to the genus *Migonemyia*.

Analyzing the two specimens of *Mg. vaniae*, we observed that the parameter is digitiform and its dorsal margin is slightly convex (Fig. 1C), while the specimens of *Mg. migonei*, the dorsal margin of the parameter is strongly convex (Fig. 1D), as shown by Galati et al. (2007).

The species were confirmed by studying the morphometry of their aedeagal ducts, which is a taxonomic character pointed out by Galati et al. (2007). We observed that the two specimens of *Mg. vaniae* had an average spermathecal pump length of 145.803 µm and an average aedeagal duct length of 646.37 µm; in four specimens of *Mg. migonei* these were 122.40 µm and 545.06 µm, respectively (Table 1).

Discussion

Galati et al. (2007) described *Migonemyia vaniae* from the Ribeira Valley, a rural region of the state of São Paulo, near an Atlantic Forest reserve (24°33'01"S, 048°40'15"W). Although this previously known occurrence (the type locality) in the municipality of Santo André and our new record MS4 are 665 km apart, the two areas have important similarities in their biotopes (Fig. 2).

Both collection sites are fragments of Atlantic Forest and have a dense ombrophilous forest vegetation with high-altitude tropical climate (INEA 2009; Secretaria de

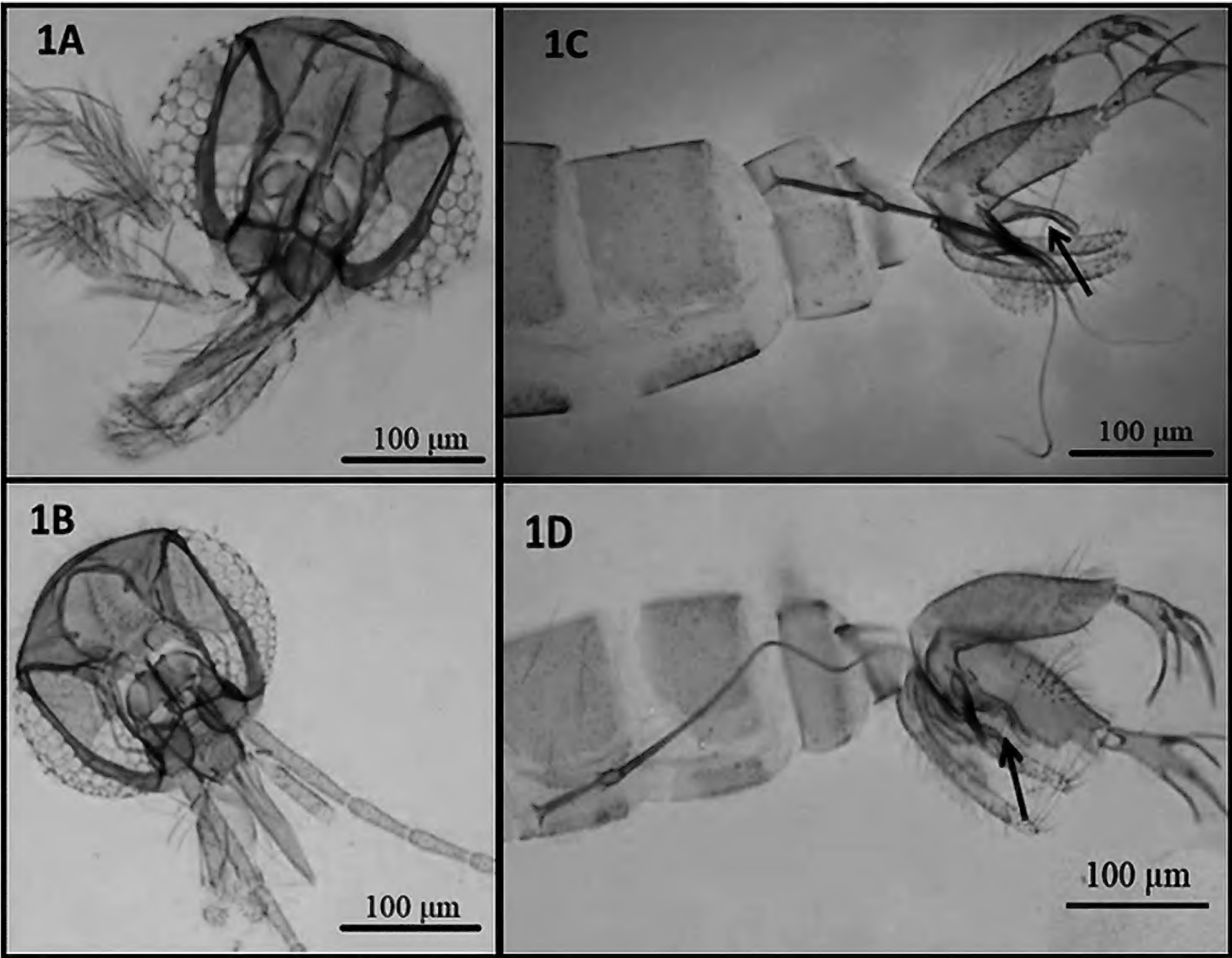


Figure 1. *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007 and *Migonemyia migonei* (França, 1920). **A.** *Mg. vaniae* head. **B.** *Mg. migonei* head. **C.** *Mg. vaniae* genitalia presenting the parameter (arrow), which is slightly convex in the dorsal margin. **D.** *Mg. migonei* genitalia presenting the parameter (arrow), which is strongly convex in the dorsal margin.

Table 1. Measurements of the spermatic pump (S.P.) and aedeagal ducts (E.D.) of the species *Migonemyia vaniae* and *Migonemyia migonei*.

Specimen		<i>Mg. vaniae</i>	<i>Mg. migonei</i>
1	S.P.	140.969 µm	122.344 µm
	E.D.	629.562 µm	527.964 µm
2	S.P.	150.638 µm	135.977 µm
	E.D.	663.185 µm	543.928 µm
3	S.P.	—	123.507 µm
	E.D.	—	542.305 µm
4	S.P.	—	107.761 µm
	E.D.	—	565.828 µm
Average	S.P.	145.8035 µm	122.3973 µm
	E.D.	646.3735 µm	545.0063 µm

Infraestrutura e Meio Ambiente 2020) and these account for the presence of *Mg. vaniae* in both sites. However, the altitude of the encounter of the type species and our report showed variation, where our new record was 464 meters above sea level, while the Ribeira Valley is 260 m above sea level, suggesting the encounter of this species within this range of altitude.

The genus *Migonemyia* has three species, of which *Migonemyia rabelloi* (Galati & Gomes, 1992) and *Mg. vaniae* were described from and only known from the

state of São Paulo (Galati et al. 2007). *Migonemyia migonei* has the greatest distribution and consequently its biology and medical importance is the best known.

Migonemyia migonei is naturally infected with *Leishmania (Leishmania) infantum* [syn. *Leishmania (Leishmania) chagasi*; Dantas-Torres 2006] in areas of Visceral Leishmaniasis transmission, through studies using molecular techniques (De Carvalho et al. 2010; Moya et al. 2015). However, although found infected, *Mg. migonei* has not yet been characterized as a vector for Visceral Leishmaniasis (Galvis-Ovallos 2019). However, *Mg. migonei* is a secondary vector of Tegumentary Leishmaniasis according to the literature (Rangel et al. 1986; Pita-Pereira et al. 2005)

Our morphological comparisons of *Mg. migonei* and *Mg. vaniae* corroborate the descriptions by Galati et al. (2007), who found that *Mg. migonei* presents a parameter with a strongly convex dorsal margin between two concavities, and ejaculatory ducts and a sperm pump measuring ≤ 590 µm and 130 µm, respectively. *Migonemyia vaniae* has a digitiform parameter with a slightly convex dorsal margin, and ejaculatory ducts and the spermatic pump measure ≥ 640 µm and 146 µm, respectively (Galati et al. 2007; Galati 2019). Thus, our data presented

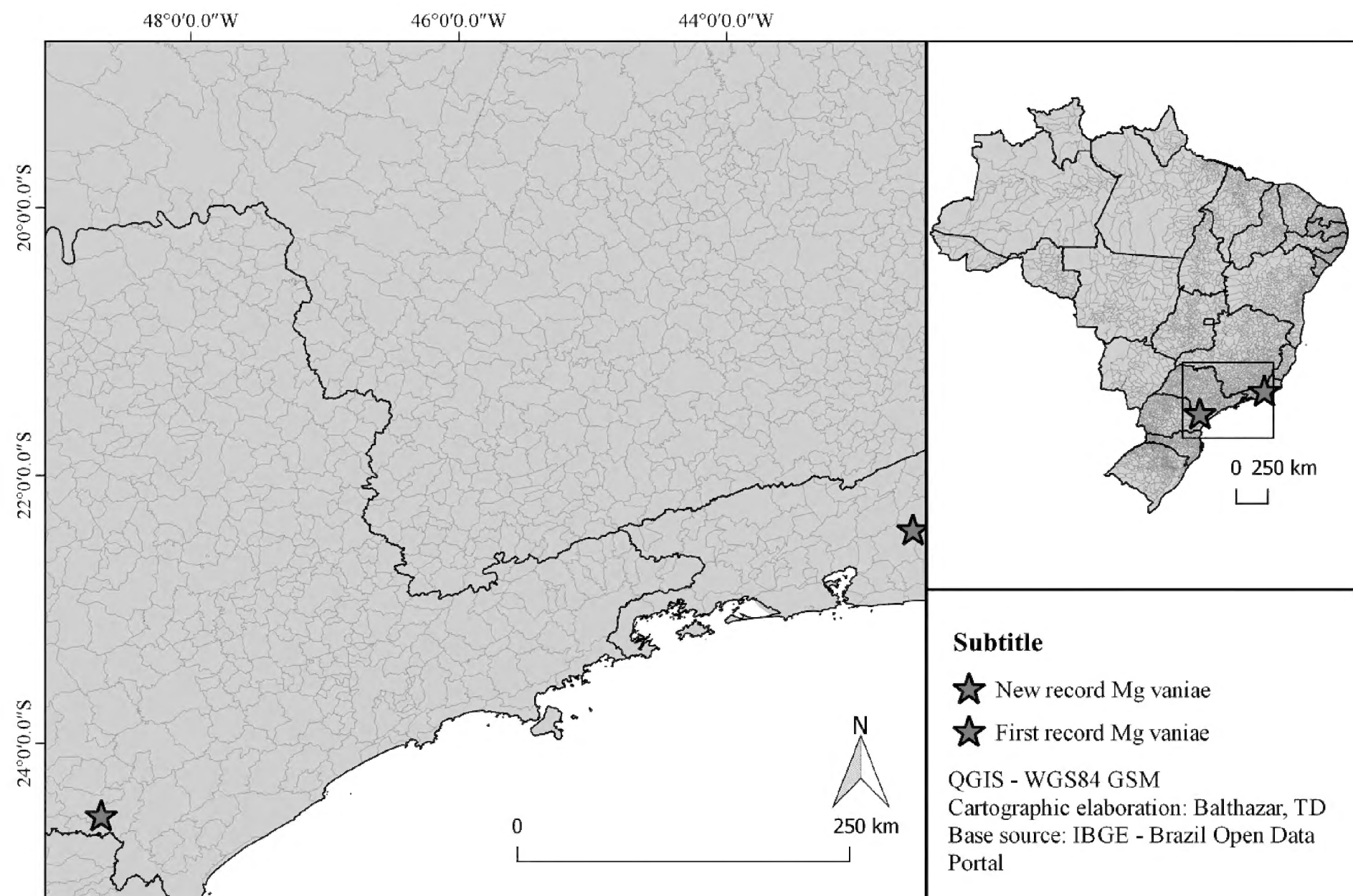


Figure 2. Distribution map of *Migonemyia vaniae* Galati, Fonseca & Marassá, 2007. **A.** Detail showing the type locality (red star, 24°33'01\"S, 048°40'15\"W) and the new record (yellow star, 22°24'53\"S, 042°36'32\"W). **B.** Map of Brazil showing the region detailed in A.

confirm the first record of the species *Mg. vaniae* from the state of Rio de Janeiro.

Migonemyia vaniae differs from *Mg. rabelloi* and *Mg. migonei* by their longer ejaculatory pump and edeagal ducts in relation to the other species.

Until now, 64 species had been reported to occur in the state of Rio de Janeiro (Galati 2019). With our new record of *Mg. vaniae*, 65 species (of the 1016 species currently described) are now known from the state (Galati 2019).

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Authors' Contributions

Conceptualization: JSM, MLV. Data curation: ALFS, LHC. Formal analysis: TDB, ALFS. Investigation: TDB, LHC. Methodology: TDB, ALFS, MLV. Resources: TDB. Supervision: JSM, MLV. Validation: MLV. Visualization: TDB Writing – original draft: TDB. Writing – review and editing: JSM, MLV.

References

- Basset Y, Cizek L, Cuénoud P, Didham RK, Guilhaumon F, Missa O, Novotny V, Odegaard F, Roslin T, Schmidl J, Tishechkin AK, Winchester NN, Roubik DW, Aberlenc HP, Bail J, Barrios H, Bridle JR, Castaño-Meneses G, Corbara B, Curletti G, Rocha WD, Bakker D, Delabie JHC, Dejean A, Fagan LL, Floren A, Kitching RL, Medianero E, Miller SE, Oliveira EG, Orivel J, Pollet M, Rapp M, Ribeiro SP, Roisin Y, Schmidt JB, Sorensen L, Leponce M (2012) Arthropod diversity in a rainforest. *Science* 338: 1481–1484. <https://doi.org/10.1126/science.1226727>
- De Carvalho MR, Valença HF, Da Silva FJ, de Pita-Pereira D, de Araújo Pereira T, Britto C, Brazil RP, Brandão Filho SP (2010) Natural *Leishmania infantum* infection in *Migonemyia migonei* (França, 1920) (Diptera: Psychodidae: Phlebotominae) the putative vector of visceral leishmaniasis in Pernambuco State, Brazil. *Acta Tropica* 116 (1): 108–110. <https://doi.org/10.1016/j.acta-tropica.2010.03.009>
- Galati EAB, Fonseca MB, Marassá AM (2007) The subgenus *Migonemyia* (Galati, 1995) (Diptera, Psychodidae, Phlebotominae), with description of a new species *Migonemyia vaniae*. *Memórias Instituto Oswaldo Cruz* 102 (5): 605–615. <https://doi.org/10.1590/S0074-02762007005000064>
- Galati EAB (2003) Classificação de Phlebotominae. In: Rangel EF, Lainson R (Eds.) *Flebotomíneos do Brasil*. Ed. Fiocruz, Rio de Janeiro, Brazil, 23–51.
- Galati EAB (2019) Phlebotominae (Diptera, Psychodidae): classificação, morfologia, terminologia e identificação de Adulto. Public Heath School, University of São Paulo, São Paulo, Brazil, 132 pp. <http://www.fsp.usp.br/egalati/index.php/2018/07/24/materiais/>. Accessed on: 2021-01-25.
- Galvis-Ovallos F, Da Silva MD, da Silva Bispo GB, De Oliveira AG, Neto JRG, dos Santos Malafronte R, Galati EAB (2017) Canine visceral leishmaniasis in the metropolitan area of São Paulo: *Pin-*

- tomyia fischeri* as potential vector of *Leishmania infantum*. Parasite 24: 2 <https://doi.org/10.1051/parasite/2017002>
- Hamilton AJ, Basset Y, Benke KK, Grimbacher PS, Miller SE, Novotny V, Samuelson GA, Stork NE, Weiblen GD, Yen JDL (2011) Quantifying uncertainty estimation of tropical arthropod species richness. The American Naturalist 176: 90–95. <https://doi.org/10.1086/652998>
- INEA (Instituto Estadual do Ambiente) (2009) Plano de manejo: Parque Estadual dos Três Picos. Versão integral. Governo do Estado do Rio de Janeiro, Rio de Janeiro, Brazil, 627 pp.
- Lamarre GP, Hérault B, Fine PV, Vedel V, Lupoli R, Mesones I, Baraloto C (2016) Taxonomic and functional composition of arthropod assemblages across contrasting Amazonian forests. Journal of Animal Ecology 85 (1): 227–239. <https://doi.org/10.1111/1365-2656.12445>
- Marcondes CBA (2007) Proposal of generic and subgeneric abbreviations for Phlebotomine sandflies (Diptera: Psychodidae: Phlebotominae) of the world. Entomological News 118: 351–356. [https://doi.org/10.3157/0013-872x\(2007\)118\[351:apogas\]2.0.co;2](https://doi.org/10.3157/0013-872x(2007)118[351:apogas]2.0.co;2)
- Maroli M, Feliciangeli MD, Bichaud L, Charrel RN, Gradoni L (2013) Phlebotomine sandflies and the spreading of leishmaniasis and other diseases of public health concern. Medical and Veterinary Entomology 27 (2): 123–147. <https://doi.org/10.1111/j.1365-2915.2012.01034.x>
- Moya, SL, Giuliani, MG, Acosta, MM, Salomón, OD, Liotta, DJ (2015) First description of *Migonemyia migonei* (França) and *Nyssomyia whitmani* (Antunes & Coutinho) (Psychodidae: Phlebotominae) natural infected by *Leishmania infantum* in Argentina. Acta Tropica 152: 181–184. <https://doi.org/10.1016/j.actatropica.2015.09.015>
- Pita-Pereira, D, Alves, CR, Souza, MB, Brazil, RP, Bertho, AL, Figueiredo, AB, Britto, CC (2005) Identification of naturally infected *Lutzomyia intermedia* and *Lutzomyia migonei* with *Leishmania (Viannia) braziliensis* in Rio de Janeiro (Brazil) revealed by a PCR multiplex non-isotopic hybridisation assay. Transactions of the Royal Society of Tropical Medicine and Hygiene 99: 905–913. <https://doi.org/10.1016/j.trstmh.2005.06.019>
- Pugedo HR, Barata A, França-Silva AJ, Silva JC, Dias ES (2005) HP: an improved model of suction light trap for the capture of small insects. Revista da Sociedade Brasileira de Medicina Tropical 38: 70–72. <https://doi.org/10.1590/s0037-86822005000100017>
- Rangel EF, Lainson R (2003) Flebotomíneos do Brasil. Editora da Fiocruz, Rio de Janeiro, Brazil, 368 pp.
- Rangel EF, Souza NA, Wermelinger ED, Azevedo ACR, Barbosa AF, Andrade CA (1986) Flebótomos de Vargem Grande, foco de leishmaniose tegumentar no estado do Rio de Janeiro. Memórias do Instituto Oswaldo Cruz 81: 347–349. <https://doi.org/10.1590/S0074-02761986000300013>
- Secombe AK, Ready PD, Huddleston LM (1993) A catalogue of Old World Phlebotomine sandflies (Diptera: Psychodidae, Phlebotominae). Occasional Papers on Systematic Entomology 8: 1–57.
- Secretaria de Infraestrutura e Meio Ambiente (2020) Paranapiacaba – informações gerais. <https://www.infraestruturameioambiente.sp.gov.br/institutodebotanica/paranapiacaba/informacoes-gerais/>. Accessed on: 2020-03-13.
- Vilela ML, Zwetsch A, Silva JS (2018) Methods for Capturing, Processing and Preserving Phlebotominae. In: Rangel EF, Shaw JJ (Eds.) Brazilian sand flies. Springer International Publishing, Rio de Janeiro, Brazil, 443–466. https://doi.org/10.1007/978-3-319-75544-1_10
- Young DG, Duncan MA (1994) Guide to the identification and geographic distribution of *Lutzomyia* sand flies in Mexico, the West Indies, Central and South America (Diptera: Psychodidae). Memoirs of the American Entomology Institute 54. Associated Publishers, Gainesville, USA, 881 pp. <https://doi.org/10.21236/ada285737>